

HOLTRACHEM MANUFACTURING COMPANY SITE
ORRINGTON, MAINE

PRELIMINARY MEDIA PROTECTION STANDARDS
AND
CORRECTIVE MEASURES STUDY WORKPLAN

BASIS STATEMENT AND RESPONSE TO COMMENT

DECEMBER 31, 2002

Issued by US Environmental Protection Agency and Maine Department of Environmental Protection

I. Introduction

The HoltraChem Manufacturing Company (HoltraChem) site in Orrington, Maine is located on a 235-acre property on the banks of the Penobscot River. Approximately 50 acres are developed and include the manufacturing facility, five landfills, a surface impoundment and a scrap metal area. The immediate plant area is approximately 12 acres. The facility opened in 1967 and manufactured chlorine, caustic soda (sodium hydroxide), and chlorine bleach (sodium hypochlorite) used primarily by the region's paper mills. The plant also manufactured hydrochloric acid and the pesticide chloropicrin. The plant closed in September, 2000.

The plant used a chlor-alkali process to separate sodium and chlorine from salt water. In this process, elemental mercury was used as a cathode to collect the sodium from the water. The chlor-alkali process is an older technology and has been replaced by mercury-free production techniques at newer plants and some converted older plants. When it stopped operations in 2000, HoltraChem was one of 13 chlor-alkali plants left in the country. There were as many as 30 chlor-alkali plants in the United States at one time.

The HoltraChem facility has been owned and operated by three different companies. The plant began operation in 1967, under the ownership of International Minerals and Chemical Corporation (IMC), which in the 1990's became known as the Mallinckrodt Group Inc. (Mallinckrodt). In 1974 IMC transferred the plant to Sobin Chemical, a subsidiary that was 80% owned by Mallinckrodt which in 1977 merged back into IMC. In 1982 IMC sold the plant to LCP Chemicals and Plastics Inc (LCP) which changed its name in 1988 to the Hanlin Group, Inc. (Hanlin). In 1991 Hanlin filed for bankruptcy. HoltraChem purchased the property from the Hanlin bankruptcy estate in 1994.

A site investigation, completed in 2000, determined that the HoltraChem property is contaminated with mercury, chloropicrin and several volatile organic compounds. Sediment in the Penobscot River is also contaminated with mercury from the site. Additional investigation in 2001 revealed the presence of mercury and polychlorinated biphenyls (PCBs) at other areas on and adjacent to the site.

The following contaminants are known to be present on site:

Air: mercury.

Biological samples: mercury.

Groundwater: manganese, mercury, acetone, m-cresol, p-cresol, 1,1 dichloroethane, 1,1 dichloroethene, cis 1,2 dichloroethene, trans 1,2 dichloroethene, carbon disulfide, carbon tetrachloride, bromoform, chloroform, chloropicrin, hexachloroethane, methylene chloride, pentachloroethane, bromodichloromethane, dibromochloromethane, methane, trichloroethene, tetrachloroethene, and 2,4,5-T. Abnormal values for pH, alkalinity, salinity, and specific conductance are present.

Sediment: mercury.

Soils: cadmium, mercury, chloropicrin, ethylbenzene, xylenes and polychlorinated biphenols.

Surface Water: mercury, chloroform, and carbon tetrachloride. Abnormal values for pH, alkalinity, salinity, and specific conductance are present.

Under DEP supervision, HoltraChem has already started a series of RCRA closures involving the cleaning and decontamination of RCRA units (such as tanks). Additional work is needed to complete the RCRA closures, this work will continue under DEP oversight.

II. Purpose of this Document

This document summarizes and addresses the public comments received on the proposed Preliminary Media Protection Standards (PMPS) and the Corrective Measures Study (CMS) workplan submitted to the EPA in accordance with the Consent Decree entered into by the United States and Hanlin, Civil Action No. 91-0188-B (D.Ct. Maine) in 1993 and amended in 1995 to join HoltraChem as a party defendant (the Consent Decree). It also summarizes the basis for the agencies' findings and decisions on the PMPS set for the site. This document does not address the few comments received that were not germane to the two documents and/or the corrective action process.

The purpose of the CMS is to develop and identify all corrective measures or remedies that could achieve remediation of the site. It will focus on realistic cleanup choices for the site based on the type and migration of the contamination identified in the site investigation. Mallinckrodt will be taking over the Corrective Action process from HoltraChem from this stage forward. In its report following the CMS, Mallinckrodt will recommend and justify those remedial options and media cleanup standards that best meet the criteria for remedy selection under the RCRA Corrective Action Program. These criteria are presented in Section V. The media clean up standards are known as proposed media protection standards or PMPS's until they are accepted or modified by the regulatory agencies. The findings and conclusions of the CMS will be subject to public review and comment, including a public meeting, which will be scheduled after the CMS Report is submitted by Mallinckrodt to DEP and EPA.

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III. Summary of Comments and Response to Comments

KEY TO COMMENTORS

CODE	NAME AND ORGANIZATION	RESIDENCE	REPRESENTING/ MEMBER OF
Bahr	Dan Bahr	Orrington	
Boudreau	Avery Boudreau	Orrington	
NRCM	Nick Bennett, NRCM	Hallowell	Natural Resources Council of Maine
Connor	Lori Connor	Deer Isle	
JDK	John Dieffenbacher- Krall, MPA	Hudson	Maine People's Alliance Penobscot Alliance for Mercury Elimination
Defran	Andrea Defrancesco	Penobscot	
TAC	Will Everitt, Toxics Action Center	Portland	Toxics Action Center
Free	Jim Freeman	Verona Island	Penobscot Alliance for Mercury Elimination
MPA	Jesse Graham, MPA	Bar Harbor	Maine People's Alliance Penobscot Alliance for Mercury Elimination
Grant	Jim Grant	Missouri	Mallinckrodt
Hanes	Jay Hanes	Winterport	
Hessel	Steve Hesseltine	Winterport	
Holmes	Julian Holmes	Wayne	
TM	Dexter Johnson, Town	Orland	Town Manger of Orrington
Pjudd	Patricia Judd	Orrington	Maine People's Alliance
Rjudd	Richard Judd	Orrington	Maine People's Alliance
Lee	Diane Lee	Orland	
MPSR	Paul Averill Liebow, MPSR	Bucksport	Maine Physicians for Social Responsibility
Leslie	Heather Leslie	Orrington	
Kpear	Keith Pearson	Blue Hill	Penobscot Alliance for Mercury Elimination
Person	Pam Person	Orland	Former Maine Environmental Priorities Project
Rand	John Rand, PAME	Raymond	Penobscot Alliance for Mercury elimination, JBR Consulting
Rosen	Richard Rosen	Bucksport	State Representative
Silber	Alan Silberberg	Orrington	
Weiss	Eleanor Weissman	Winterport	

These comments are based upon written comments submitted into the record and verbal comments made at the public hearing. Special thanks to Bill Philip for his copying and making available to the agencies the video of the public hearing which was used as a record of the verbal comments made at the meeting. While it was intended to produce a written transcript of the public hearing, the stenographer's notes were unfortunately stolen from her vehicle on her way home the night of the public hearing. Therefore there is no official transcript of the hearing.

Preliminary Media Protection Standards (PMPS) comments:

General

Comment: 1

I believe that the PMPSs provide a reasonable starting point to move the CMS process forward toward final site remediation. Additional data that will be developed during the CMS, and relative to the court ordered downriver study, will shed light on the need for adjustments or additions to the PMPSs. (Rand)

Response:

The agencies agree with the commentor.

Comment: 2

Mallickrodt believes that the PMPS as proposed are protective of human health and the environment. We believe in all cases the most stringent standard appropriate was selected. We are ready to move forward with cleaning up the site. (Grant)

Response:

The agencies agree with the commentor that the PMPSs proposed in the Site Investigation Report are appropriate, with the exception of the PMPS for sediment and soil. The agencies further agree that it is time to move forward with the clean up.

Comment: 3

We believe EPA and DEP (the agencies) should provide more information on why they believe the PMPS will be adequately protective of human health and the environment. Table 1 simply provides the PMPS numbers, but gives no explanation of why the agencies believe they are reasonable or their regulatory basis (NRCM)

Response:

The agencies have provided additional explanation on the basis for the PMPSs in Section V of this document. Also please refer to the Site Investigation Report for further explanation on the basis for the PMPS.

Comment: 4

Based upon the experience with MTBE which DEP and EPA admitted was a mistake, why should we trust these agencies? How much trust should we have for them and how much do we closely have to watch these people to be sure that this time they are telling the truth. (Holmes)

Response:

The agencies make the best decisions that they can with the information that they have. This is not to say that every decision will be perfect. Often environmental decisions, as with other types of decisions, are the best balance of the factors given the information that is available. As new studies are concluded new

information is gained which sometimes would change earlier decisions. With remediation decisions in particular, agencies continually weigh the delay that collecting more data will entail against the benefits of moving ahead with the cleanup. The public comment on this site reveals elements of this debate among the various commentors, some wanting us "to get on with it" and others wanting us to study the situation further. The agencies have tried to balance these competing needs and to make decisions to initiate remedial work at points when they feel that additional study or data, while helpful, is unlikely to change the ultimate decision.

Comment: 5

What is going on now that will be a problem in 30 years? (Connor)

Response:

The agencies are unfortunately unable to predict what issues will emerge in the future. We have to work and make decisions with what is known today. Risk assessments recognize uncertainty by what are called "safety factors." Safety factors include using a "conservative" time of exposure and multiple exposure pathways to help provide a safety buffer around risk based clean up decisions

Comment: 6

I am very concerned about the clean-up of the mercury pollution, not only at the plant but throughout the area and further downstream. I urge you to insist on the most thorough clean-up as possible. (Weiss)

Response:

The agencies share the commentor's concerns and concur with the need to have the "most thorough clean-up as possible." As government officials, we must take into account factors including the risks of the remedy itself and the ability to implement it.

Comment: 7

The plan when fully completed must meet three objectives:

- (1) a clean Penobscot River by removing dangerous materials in a way that improves the safety and water quality for years to come;
- (2) security for the health of the residents that live near the site by the aggressive remediation of the site through containment or removal of old landfills, removal and clean up of the building sites, protection of groundwater and well water which are thorough, detailed, meticulous and ongoing if necessary; and
- (3) a property and remaining infrastructure which is available for future economic development through a successful clean up so that the town has the option of returning property to some type of productive use. (Rosen)

Response:

The agencies share the commentor's objectives for the site clean up. It is our intent to require the removal of highly contaminated sources of mercury from the Penobscot River. This will speed the river's natural recovery time. The agencies hope that as a result of this removal and other actions to reduce mercury inputs to the river, both from the HoltraChem site and from other sources, that the river will someday be free from fish advisories.

It is the intent of the agencies to ensure that any landfills remaining onsite are properly maintained and monitored. The buildings onsite which are contaminated with mercury are scheduled for decontamination and removal. The portion of the groundwater that flows toward the neighboring residents is currently being captured, treated and monitored. This collection system is expected to continue operating until the groundwater pollutants reach safe levels. Groundwater with heavy contamination that is flowing towards the Penobscot River will be captured and treated in a second collection system as a part of the CMS process.

It is doubtful that the contaminated areas of the plant will be available for economic development in the near future, if ever. The site does consist of 235 acres and approximately 158 acres are believed to be uncontaminated, and which will likely be available for economic development at some point in the future.

Comment: 8

Representative Rosen has the right three criteria for the clean up:

- (1) river clean up;
- (2) protect people; and
- (3) clean site for economic development. (JDK)

Response:

See above response to comment 7.

Comment: 9

Methyl-mercury found in Killifish (a minnow) at Frankfort Flats was .125 ppm. Mallinckrodt used this research to say there was no cause for alarm as .125 ppm falls under the 0.2 ppm that is Maine's fish tissue action level. On a closer look at a typical pattern of biomagnification as reported by the DEP, which shows a 100-fold increase in methylmercury concentration from minnows, like killifish, to predators. We would find a predator, such as bass, feeding on those fish having accumulated a highly toxic mercury concentration of 12.5 ppm. This is over 60 times Maine's fish tissue action level.

Once ingested the mercury is absorbed into the blood and distributes to all tissues, the brain and to a developing fetus. In an adult it can take 9 months to excrete but in a fetal brain the mercury can never be excreted. Thus a pregnant woman could not eat a single Penobscot River fish without endangering fetal health. Already ten to twenty percent of women in Maine have blood mercury level that are too high for the developing fetus.

Because of bioaccumulation and biomagnification the media protection standards need to be stronger in order to protect public health.

Mercury concentrations in Penobscot cormorant feathers and blood are the highest in Maine and osprey breeding is below the rate required to sustain the population.

Available lobster data show that Penobscot lobster tomalley have some of the highest mercury concentrations in the state. The highest concentrations were found at Fort Point Cove. Humans regularly consume lobster tomalley.

Blue mussels for Sandy Point had the second highest levels of mercury. Mussels tested at Pickering Island, also in Penobscot Bay, contained higher concentrations than other areas. This is of particular concern because over 821 tons of blue mussels are landed each year in Maine.

A wildlife study conducted during July and August 2000 along the east side of Verona Island found no cormorants or other waterbirds on the water, no shore birds on the flats, and few shoreline plants, fish or shellfish. This area is designated a Class A habitat, an area of national significance for wildlife.

Given all of this the Media Protection Standards need to be stronger (MPA)

Response:

Most of the killifish composites found in the Penobscot River were not at a concentration of .125 ppm. This was one of the higher concentrations found not the typical concentration. While a single high value may elicit concern, it is not a typical concentration to which predator species are exposed. When evaluating biological data such as this, it is more appropriate to use an average concentration since this is more representative of what higher trophic levels (predators), such as eels, would eat. Predators are by necessity somewhat opportunistic in what they eat rarely if ever restricting their diet to one species. The result is that their diet consists of many individuals containing a range of concentrations. During colder months, for example, killifish are not readily available as prey. Also, individual predators cover larger home ranges than their prey and hence their diet represents a wider area of exposures than just the local area where concentrations are highest. If this were not the case, one would see much higher concentrations in the predators. Indeed, mercury concentrations in predator species corroborate that their diet is varied. For example, mercury in eels (mean of 0.5 ppm from the CDM data on the Penobscot) are two orders of magnitude lower than hypothesized (12.5 ppm) by the commentor.

The maximum killifish composite mercury concentration in the Penobscot River was .125 ppm. By comparison, by averaging the Kennebec River fish samples at each sampling station, the maximum killifish mercury concentration was .1 ppm. The lower Penobscot is somewhat elevated over the Kennebec River fish mercury

levels but not substantially elevated. Based upon the combined data of CDM and Evers, we know that individual samples of fish (killifish) from the Kennebec River have been as high as .176 ppm which is above the maximum level found in the Penobscot River.

The referenced figure from the Land & Water Resource Council (1998) report is conceptually true but this figure is for large complex trophic systems that are typically found in large lakes. In situations with large complex food webs the greatest biomagnification will occur. In such cases, mercury concentrations in large predator fish may be 100 times greater than mercury concentrations in forage fish. However food webs are often shorter and less complex. In these shorter less complex food webs, mercury concentrations in predator species may be less than 10 X the concentrations in the forage fish. River food chains tend to be short. Although data is limited, mercury concentrations in samples of fish from the Penobscot River follow this observation. The data suggest that the forage fish to predator fish magnification factor is 10 or less (approximately .5 ppm in eels versus .05 ppm (10X) or .125 ppm (4X) in killifish.). This is not to say that .5 ppm in eels is acceptable for human consumption but to address the issue of whether the use of this generic biomagnification figure of 100 times to 12.5 ppm is appropriate for use in the Penobscot River. It does not appear from the data that it is appropriate to use a biomagnification figure of 100 times for this situation.

There is one further point regarding the suggestion that biomagnification would lead to 12.5 ppm in the Penobscot River. The reality is that, in the United States, mercury concentrations measured in any species, including predators are rarely if ever greater than 2 ppm. This has been demonstrated in national surveys (USEPA, 1992; Lowe et al., 1985; Schmitt and Brumbaugh 1990), as well as in surveys on fish from Maine lakes and rivers (Attachment 1, Table 2). A concentration of 12.5 ppm would probably be hazardous to the fish and would definitely be hazardous to a predator that consumes such a fish. Lower concentrations than 12.5 ppm would constitute an unacceptable risk as mentioned in the above paragraph, however whether a predator species in the lower Penobscot River will actually accumulate mercury to the levels suggested by the generic diagram is doubtful and certainly not supported by the data gathered in Maine.

There is now substantial scientific consensus that a methylmercury dose of 0.1 micrograms per kilogram body weight per day ($0.1 \mu\text{g/kg/day}$) poses a negligible risk of a deleterious response even among individuals belonging to sensitive subpopulations, such as the developing fetus exposed via the maternal diet. This consensus is evident in a U.S. Congressionally mandated report by the National Academy of Science National Research Council, which reaffirmed a dose of $0.1 \mu\text{g/kg/day}$ as scientifically justifiable for the protection of public health.¹ It is

¹ Toxicological Effects of Methylmercury, National Research Council, National Academy Press, Washington, DC (2000); pp: 326-329.

also evident in U.S. Environmental Protection Agency's recently updated *Reference Dose* (RfD) for methylmercury, which was subject to additional external scientific peer review.² The USEPA RfD of 0.1 µg/kg/day has in turn been recommended as appropriate for use in Europe by the European Commission's Working Group on Mercury.³ Remaining debate surrounding this RfD mostly concerns whether this value is unnecessarily too conservative, in part motivated by the results from one large prospective epidemiological study of a fish eating population that has failed to document any significant deficits in cognitive function among children exposed *in utero* to methylmercury doses considerably higher than average exposures in the U.S.^{4,5}

The Maine Bureau of Health bases its statewide fish consumption advisory for mercury contamination on the U.S. EPA RfD of 0.1 µg/kg/day.⁶ A pregnant woman could consume one 8-ounce meal per week of fish containing on average about 0.2 mg/kg mercury without exceeding the RfD of 0.1 µg/kg/day, if this was her only source of exposure to methylmercury. Fish with average mercury levels of 0.6 mg/kg could be consumed at least once per month without exceeding the RfD of 0.1 µg/kg/day. Samples of striped bass caught on the lower Penobscot River were found to have mercury levels of 0.12 to 0.20 mg/kg. Eels were found to average about 0.6 mg/kg.

The comment that 10 to 20 percent of Maine women already have mercury exposures too high for the developing fetus is apparently in reference to unpublished Bureau of Health survey data of about 100 Maine women of childbearing age that found 20 percent with hair levels above 1 mg/kg. According to the State Toxicologist, a hair level of 1 mg/kg is approximately associated with a daily intake of 0.1 µg/kg/day. It should be noted that among those Maine women with hair mercury levels greater than 1 mg/kg, the majority of fish consumed was reported to be purchased commercial fish, not locally caught fish.

To clean the river to below fish advisory levels, we would need to clean the sediment to below background. This is based upon a biomagnification factor of 10 as measured in the Penobscot River biomagnification of killifish to eel, as well as the river specific organic content, and the small fractional transfer of sediment mercury to mercury contained in killifish. Getting sediments down to a concentration that would get predator fish to 0.2 ppm or below, the sediment would need to be well below the background mercury sediment levels. This is because very little of the mercury in the fish seems to be coming from the

² <http://www.epa.gov/iris/subst/0073.htm>

³ Ambient air pollution by mercury (Hg). Position Paper, European Commission, European Union, 17 October 2001. <http://europa.eu.int/comm/environment/air/ambient.htm>.

⁴ *Toxicological Profile for Mercury*, U.S. Agency for Toxic Substances and Disease Registry, Atlanta, GA (1999).

⁵ Dourson ML et al., *Uncertainties in the reference dose for methylmercury*, *Neurotoxicology*, Vol. 22(5):677-689 (2001).

⁶ *Bureau of Health Fish Tissue Action Levels*, Maine Department of Human Services, Bureau of Health, Augusta, ME, February 20, 2001.

sediment. If sediment were removed to below background levels sediments would become recontaminated since the background levels of mercury are higher. Also to dredge 24 miles of river to achieve this concentration would not be without significant damage to the environment in and of itself.

A coastwide study of mercury levels in juvenile cormorants included one site in Penobscot Bay, Flat Island which is located off Islesboro. Concentrations in feathers (5,069 ng/g) and blood (541 ng/g) indeed place those birds as having the highest feather concentrations and tied for second highest blood concentrations. Ranking, however, is not the entire story. Flat Island birds are comparable to those sampled in Portland Harbor, off Kennebunk, and in Saco Bay. Because the site is almost 20 miles from Orrington, it's value as an indicator of conditions in Orrington is almost negligible since the forage range of these bird's mothers is only about 10 miles. Rather, the Flat Island site is an integrator of the overall environment that derives its mercury load from the multitude of sources both present and historical including atmospheric deposition, urban runoff from surrounding towns and cities including Belfast, Camden, Rockland, Searsport and Bucksport, all the uprivers sources including pulp and paper, other industries and municipalities, and dredge disposal sites, to name just a few of the most obvious.

We know that in 2001, osprey productivity was down. However evidence that the low success rate of osprey breeding on the Penobscot River is attributable to mercury is tenuous for a couple of reasons:

- (1) One year earlier, nesting success rates for both the Penobscot River and Kennebec River birds were above levels needed to maintain populations in the eastern United States (Poole 1989). The decline for Penobscot River birds occurred, or became evident in 2001, even though mercury concentrations in Penobscot River media have been elevated for years if not decades.
- (2) In 2000 the nesting success rate for Penobscot River birds was comparable to that observed with Kennebec River birds. However, in 2001 the nest success rate for Penobscot River birds was, by one measure, less than 1/2 that of the Kennebec River birds. It may be argued that the difference in 2001 reflects mercury levels that are higher in the Penobscot River food web than in the Kennebec River food web. The argument runs counter to the observation that, in the previous year, Penobscot River birds were as successful as Kennebec River birds even though mercury was present in the river during that year as well.
- (3) Osprey nest success is known to be strongly influenced by factors other than contaminants, including weather, food availability, and disturbance. Such factors are more likely to cause year-to-year fluctuations than is the mercury contamination, which has been in the system for many years.

Mercury in the meat of Penobscot River lobsters is low relative to lobster in other areas of the state. Such appeared to be the case with the 1995 samples. Mercury levels in the tomalley were higher than the average. The tomalley concentrations represent a different aspect of exposure than do mercury levels in the meat. Contaminant levels in tomalley may reflect "spikes" from most recent meals, whereas levels in muscle may reflect the average from exposure over a longer period. While both meat and tomalley are of interest, the distinction raises the question of which is the more meaningful medium for monitoring purposes. Wildlife consume the entire animal, for which mercury concentrations will be much lower than for tomalley alone. With regard to human health, the State has a state-wide consumption advisory on lobster tomalley due to concerns about contaminants in general (Attachment 2). Therefore sensitive humans should be eating only lobster meat, which had lower levels of mercury than in other parts of the state. In fact, for mercury levels alone, in both meat and tomalley, the levels are below the human health consumption advisory level when properly converted to wet weight.

It is true that mussels in the Penobscot are elevated in relation to the state's reference concentration of 0.38 ppm dry weight which is used to distinguish elevated from normal Maine concentrations. (<http://www.state.me.us/dep/blwq/docmonitoring/sowles/mempintro.htm>). However, the concentrations are very comparable with those collected from other large river estuaries like the Kennebec, Royal, Piscataqua and Presumpscot reflecting the widespread nature of mercury contamination around the state. As for the assertion that Penobscot mercury is responsible for the mercury concentrations in Pickering Island mussels, it is not plausible. In addition to the large distance involved, over 40 miles, sites between Pickering and Orrington that are more hydrologically connected (Belfast, Rockland, Cape Rosier, and Searsport) all have lower levels of mercury than Pickering. A recent study by the University of New Hampshire (Steven Jones, UNH, personal communication) in the Stonington area indeed suggests that a source closer to Stonington may be responsible for these elevated levels.

The concern that mercury levels in mussels pose a threat to human consumers is an entirely different question from whether the concentrations are elevated. Dry weight concentrations are not directly comparable to reference toxicity values (i.e., dietary effect levels), which are fresh or wet weight concentrations. Samples collected from Fort Point in 1993, 1996, and 1999 for the Gulfwatch Program indicate that mercury concentrations are about 0.6 ppm on a dry weight basis. To convert to a wet concentration, the form used for dietary exposure, one must account for water content. Fort Point mussels are about 15% solids. To convert to edible wet weight, one multiplies by the percent solids. Therefore, 0.6 ppm dry weight is actually 0.09 ppm wet weight, which is below the current fish tissue action level of .2 ppm. Even using the highest concentration measured, 1.22 ppm in 1993 which had 8% solids, the edible concentration is 1.0, still below the advisory level.

The wildlife survey noted that there were few birds using the open water or the extensive intertidal mudflats. The commentor stated that few shoreline plants or shellfish present on Verona Island. The comment is partly a misquote of the original report, in the report no remarks could be found on the paucity of plants and shellfish in the area of concern. Consequently, it is not possible to confirm that plants and shellfish are indeed absent from the area in question. It is stated in the survey that as a backwater area, the substrate may support a less productive benthic community, which translates into fewer numbers of species that consume benthic organisms.

The absence of wildlife use in the area of concern was less pronounced in the 2001 survey. Again, it was suggested that benthic invertebrates, which are prey for fish and wading birds, are the limiting factor and that the substrate may be inhospitable due to accumulations of sawdust. Studies on the substrate and benthic community in the area of concern might help explain the apparent lack of activity.

It is agreed that aquatic habitats on the east side of Verona Island appear to be underutilized. It is suspected that there is a lack of prey species that serve as food for certain fish and wildlife, and this lack is due to the quality of the sediment. The suggestion in the Wildlife survey is that data be collected on the benthic community in the intertidal mudflats. Such a survey should be accompanied by efforts to characterize the chemical and textural nature of the substrate. Results of such a survey may help explain the absence of birds and fish in the area. A quantitative study on benthic community structure is needed to determine if there is a problem. A second set of studies is necessary to establish mercury as a cause for the observed impacts, if any on the benthic community. For the latter, it will be necessary to demonstrate a correlation between mercury concentrations in the sediment and measures of adverse effects (i.e., benthic community metrics and toxicity test results). If there is evidence of adverse effects that cannot be correlated with mercury levels, it must be concluded that factors other than mercury are responsible. Presumably this will be part of the court ordered river study.

The PMPS provide a good starting point for the CMS process. They will cut the source of mercury discharges from the site to the surface water through soil, groundwater and onsite surface waters. The remaining PMPS is for sediment. Because the transfer of mercury from the sediment to the biota is very small, a different PMPS for sediment will not result in a substantially different mercury level in the fish. This analysis is based upon the Penobscot River measured data of mercury levels in the sediment to mercury in the killifish.

Comment: 10

The whole river downstream from Bangor must be cleaned up to the strictest standards of Maine DEP, not the less strict standards of EPA. (MPSR)

Response:

This commentor is referring to the 0.2 fish tissue action level of the State of Maine versus the 0.3 fish tissue action level of the US EPA. While the federal level is not an actual legal standard, the state level is a legal standard (38 MRSA § 420, sub -§1-B, effective June 15, 2001). The agencies have changed the PMPS for sediment from 3.2 to 2.2 ppm in the Southern Cove to reflect the use of the 0.2 ppm action level mandated in Maine Statute. In addition during the CMS portion of the process, the technical feasibility of each of the evaluated options would need to be evaluated. It is expected that a PMPS of less than the average for the river would pose serious technical feasibility issues that would likely result in a higher PMPS value. In addition it is important to note that there is no place in the state where the 0.2 fish tissue level is achieved for predator fish. In these cases Best Management Practices for mercury dischargers are utilized to reduce mercury levels over time. This is the approach that the agencies have taken with the HoltraChem site, a Best Management Practice approach that substantially reduces the discharges from the site and that removes the areas of high mercury concentration in the sediments. However since there is a court ordered study that will be ongoing over the next 3 to 5 years, the resolution of this broader river issue will now be left until these studies are concluded.

Comment: 11

I am also extremely concerned at the fact that even after any clean-up, the mercury left will still be over 10 times the allowed amount by the State of Maine's guideline. This means that the site may forever be ruined. While I understand it is hard to remove all mercury from the environment, leaving us with a level deemed to be ten times higher than the State of Maine's Department of Environmental Protection recommends and allows elsewhere in the state is simply a crime! (Silber)

Response:

It is unclear whether the commentor intends this comment to apply to site soils or sediment in the Penobscot River. From the context of the question it appears to relate to the industrial site soil. Both the originally proposed soil clean up standard of either 3.2 ppm (when derived from the US EPA fish tissue level) or the revised number of 2.2 ppm (derived from the State of Maine fish tissue action level) is well below the residential clean up guideline for mercury in soil in Maine which is 60 ppm. It also is below the US EPA soil screening number of 10 ppm which is a value that ensures that concentrations of elemental mercury volatilizing to the air will not exceed the air standard for human health. In addition a site specific batch desorption test was conducted for soils outside of the plant area, this showed that concentrations of up to 13 ppm in soil would be protective of groundwater on the site. The 3.2 ppm value and the 2.2 value are both well below the 13 ppm. The cove sediment PMPS was changed to 2.2 ppm and the corresponding soil number for the site was also changed to 2.2 ppm to prevent recontamination of the cove sediments. The PMPS for mercury in the soils is protective of the Southern Cove sediments because erosion of soils at 2.2 ppm cannot increase the average mercury concentration of the cove given that the PMPS for the cove is an average of 2.2 ppm.

It is possible that the commentor is referring to the 3.2 ppm in the cove sediment versus the 0.3 fish tissue action level (US EPA recommended action level). Although it would be inappropriate to compare these two values, it would be a 10X difference. The 0.3 ppm fish tissue residue is however the level that is considered safe for human consumption in fish. It is not a sediment clean up standard. To obtain a sediment value that would correspond to this fish tissue level, a calculation is necessary which takes into account the transfer factor of conversion of mercury in the sediment into mercury uptake in bottom dwelling invertebrate (clams, worms, shrimp). This calculation using site specific sediment characteristics yielded a range from 3.2 to 32. The agencies set the proposed PMPS at the conservative end of this range. The other factor that needs to be taken into account is the size of the contamination area. Because the area is small, the concentration of mercury in species which humans would eat would represent a small amount of the total diet. Since neither humans nor predator fish nor wildlife that consume predator fish take all of their food from one area, the size of the area under consideration is important. We know the residents of this area are expected to be forage fish or birds that feed on forage fish. We also know that the mercury concentrations in forage fish that are residents of the cove are already below the action level. In the case of the cove, the PMPS was originally based upon the human health action level of 0.3 fish tissue level as applied to organisms directly exposed to the sediment, such as clams, worms, shrimp and benthic organisms. This results in a sediment value that is protective of humans consuming clams. This was determined to be an appropriate end point given the small size of the cove.

The fish tissue action level for the calculation has been changed to the State of Maine fish tissue action level of 0.2 which yields a sediment range of from 2.2 ppm to 22 ppm depending which total organic carbon level was utilized. This is again at the conservative end of the range. In conclusion if the commentor meant the sediment level, then neither 3.2 nor 2.2 represent values that are 10 times any set allowable value.

Comment: 12

This clean up is common sense, the media standards have to be stronger, the range has to be wider. (Defran)

Response:

The agencies have based their PMPS upon federal and state standards or site specific risk based numbers where federal or state standards were not available. See Section V of this document for additional information and also responses to comments #9, 10, 11, 13, and 14. Additional sampling will be conducted and recommendations made as a part of the CMS process and the court ordered study.

Sediment

Comment: 13

I have concerns about the media protection standards for sediment, on and off site.

The sediment standard seems to be based on federal fish tissue water quality criteria, rather than Maine's. Maine standard is stricter than the federal standard (0.2 ppm vs 0.3 ppm). Because this site is in Maine and because our Department of Environmental Protection will eventually have oversight of this cleanup, I urge EPA regulators to base the sediment standard on Maine's stricter criteria. (TAC)

Response:

Based upon public comment, the PMPS for the onsite sediment and the offsite sediment in the Southerly Cove were changed to reflect the State of Maine fish tissue action level of 0.2 versus the Federal EPA fish tissue action level of 0.3. This changes the PMPS for these two items to 2.2 ppm. Clean up to this level will effectively eliminate the highly concentrated sediments adjacent to the site as a source of contamination to the lower river. Within the Penobscot River, notwithstanding any clean up requirements the agencies might impose, the only viable protection of human health available is adherence to the State of Maine's fish consumption advisories. For the river wide PMPS, should the outcome of the study ordered by the United States District Court for the District of Maine indicate that further clean up work is necessary and feasible US EPA and Maine DEP are prepared to assist that process. The results of this study are not however expected to be available for from 3 to 5 years. For the present time, in light of the requirements for a court ordered and overseen study, US EPA and Maine DEP do not anticipate requiring further studies of the downriver to support the RCRA Corrective Action. The agencies concur with Judge Gene Carter's finding that "there is clearly no conflict between this court's order requiring study of the lower river and any agency action." The agencies further believe that it is important to deal with the high levels of mercury contamination at the site and in sediments of the Penobscot River immediately adjacent to the site as soon as practicable to maximize the reduction of risk posed by mercury released from the HoltraChem site.

Comment: 14

I am concerned about the media protection standards proposed for the sediment in the Penobscot River. Specifically, this is the only medium that is given an average to achieve (3.2 mg/kg) rather than a strict standard. I am concerned that standard based on an average to achieve can (knowingly or unknowingly) lead to a cleanup that does not protect the natural environment or public health depending on the sample grid (where and how many samples are taken). Instead, I urge EPA and DEP regulators to require a strict set standard (again, lower than 3.2 mg/kg if based on Maine's criteria) for sediment and require a comprehensive sampling plan to ensure that it is being met. (TAC)

Response:

The agencies share the commentor's concern that an average value can under certain circumstances lead to dilution of highly contaminated areas that should be removed. For this reason, a narrative performance standard was added that requires, at a minimum, that the two areas of higher contamination be removed. The PMPS standard was changed to an average of 2.2 ppm with no area above this value over a quarter acre in size. The agencies believe the lower standard coupled with a requirement that the sampling grid be designed appropriately adequately addresses this concern.

Comment: 15

Facts from the Maine District Court show serious amounts of mercury in the sediments of the lower Penobscot, including diminished bird populations near the wildlife preserves on Marsh Stream in Frankfort. Certainly, if wildlife has been affected by mercury contamination it seems likely that the potential exists to harm humans as well. It is obvious to me that limiting clean-up of the sediments in the Penobscot to the base of the HoltraChem site is quite deficient. Please tell me how you are going to address high levels of mercury down river and prevent any more contamination to enter the river from the HoltraChem site with the proposed clean-up standards. (Hanes)

Response:

First of all the intent of the PMPSs is to stop the loading of mercury from the site into the river. This will allow the river to begin to recover from the contamination from the HoltraChem site. Other than self remediation of the river, the only other way to take the mercury out of circulation from the river would be to remove it. In the Penobscot River only approximately 1% (depending on TOC value) of the mercury in the sediment is getting into the killifish. This means that for the killifish to be safe for consumption, the mercury content in the sediment would have to be much lower to achieve any reduction in the fish mercury levels. Another way of saying this is that 99% of the mercury in the killifish appears to be coming from some source other than the sediment such as perhaps mercury in the water column. If the sediment were removed from the river to eliminate this portion of the source of mercury to the fish, the destruction of habitat and the resuspension of sediment would be significant. Removal of mass quantities of sediment throughout the river is not without its own ecological and human health risks.

There is no remedial technology available to us that could eliminate the ongoing loading of mercury from nonpoint and smaller point sources and thus eliminate the need for a fish consumption advisory. While the site is currently a significant point source of mercury discharge to the Penobscot River the potential exposure to mercury in fish must be seen in the context of a region wide problem driven, at least in part, by atmospheric deposition of mercury that effects the entire northeast.

Comment: 16

In order to provide valuable input to the river sediment PMPS, it is recommended that the downriver study work plan have provisions for characterizing the areal and depth distribution of mercury in river sediments, as well as for more thorough ecotoxicological studies. (Rand)

Response:

The agencies believe that the additional downriver study will include all three of these items. The results of this study will not be available however for from three to five years from the study's start. The information will be assessed at that time.

Comment: 17

Sediment contaminant characterization in general, but particularly at depth and at additional locations further afield from the site, should be improved and expanded. The Council believes that sediment characterization in the cove and the river as a whole has been too limited, particularly at depth. More extensive characterization efforts should be required. (NRCM)

Response:

More sediment sampling is anticipated as a part of the CMS for the sediment removal in the Southerly Cove and will occur upfront prior to removal or as a part of the confirmation sampling that the clean up level has been achieved. For the lower river, the top inch is where most of the transfers of mercury occur into the food chain. Events that occur such as storm events, digging, dredging of deeper sediments would be another way that mercury is likely to make it to the shallow sediments where it would be available. Presumably sediment concentrations at depth in the greater river will be one of the subjects of the court ordered lower river study.

Comment: 18

The sediment PMPS for mercury is significantly higher than other levels established for the protection of aquatic life, such as the ER-L and ER-M of Long et al, which are 0.15 and 0.71 mg/kg respectively. According to CDM, the 3.2 mg/kg sediment PMPS is at the low end of a range based on a site specific partition coefficient, that supposedly estimates mercury bioavailability, and bioaccumulation in fish with an endpoint of the EPA fish tissue action level of 0.3 ppm. There are a number of potential problems with using 3.2 ppm as a PMPS. First, neither HoltraChem nor the agencies have done sufficient aquatic life toxicity testing at this level. The only toxicity tests performed on sediments at or above this level were 10-day tests on *Hyalella azteca*. As DEP also notes in its comments, these tests are not of adequate duration to assess chronic toxicity. Tests of longer duration (28-days) were performed on *Leptocheirus plumulosus*, but only on sediments with contamination up to 1.4 ppm mercury. Therefore, no long term toxicity tests were performed for sediments at mercury levels of 3.2 ppm. The agencies should require such testing in

the future or at least explain why they believe it is unnecessary if 3.2 ppm is going to be used as a cleanup standard for sediment. (NRCM)

Response:

The ER-M is one of two values developed for a number of contaminants. The other value is the "effects range low" (ER-L). Both are used to evaluate the potential for adverse effects of contaminants on benthic (bottom dwelling) biota. Basically, the ER-L is a concentration below which adverse effects are not expected, whereas the ER-M is a concentration above which adverse effects are considered probable. The following features should be noted about the use of the NOAA numbers.

- (1) The ER-Ls and ER-Ms are useful as initial screening tools but should not be used as clean up values. They are intended to provide helpful generic guidance on whether additional evaluation should be completed. The studies on which they are based are on sediments with multiple contaminants and it is difficult to tell which of the contaminants caused the effects that were observed.
- (2) The ER-Ls and ER-Ms are for benthic biota in marine and estuarine environments. They are based only on studies of adverse effects in benthic invertebrates. As such, they are in no way directly applicable as benchmarks for evaluating risks to humans or wildlife.
- (3) The ER-M for a single substance is the concentration above which adverse effects may be observed. However, the reliability of ER-Ms as predictors of sediment toxicity depends in part with the number of ER-Ms that are exceeded at a given location. The likelihood that toxicity will be observed when only one compound exceeds its ER-M is variable, depending on the compound. It is much more likely that toxicity will be observed as the number of compounds that exceed their respective ER-Ms increases. In this case we have the single contaminant mercury.
- (4) The ER-M for mercury, 0.71 ppm, represents even greater difficulty with relying on the ER-M because, Long *et al.* (1995) also determined that the ability of the guidelines for some substances, including mercury, to predict toxicity appeared to be limited. Specifically, incidences of adverse effects in sediments with mercury concentrations greater than the ER-L and/or ER-M were relatively low. In other words, when considering mercury only, the ER-L and ER-M tended to predict toxicity where toxicity was not observed. Therefore relying solely on the ER-M for mercury is an unreliable tool.

The agencies do, however agree that chronic toxicity tests should be done at the PMPS level to verify that toxicity at this level will not adversely effect the resident species in the cove. This can be completed as a part of the CMS.

Comment: 19

The partition coefficient approach only estimates bioavailability under the specific conditions at the time of sampling. However, sediments at 3.2 ppm mercury could potentially be left in place indefinitely and will undergo many different conditions

from those at the time of sampling. Under new conditions, bioaccumulation of mercury could be significantly higher. Also, sediments from the cove may spread both up and downstream in the river, again undergoing different conditions from those at the time of sampling, which again could potentially result in increase mercury bioavailability. Therefore, we believe the agencies must offer a more detailed explanation of why they believe 3.2 ppm in sediments is protective of aquatic life and human health given that the number is based on partitioning in a narrow set of samples from a limited time frame. (NRCM)

Response:

The 3.2 ppm, now changed to 2.2 ppm, is based upon human consumption of directly exposed organisms such as clams. Because it is using the endpoint of human consumption of resident species, the cove specific partition coefficient is utilized. It is also based upon the size of the cove and the fact that the concentration is not widespread in the river. To further support the use of the 2.2 ppm, Mallinckrodt will be required as a part of the CMS study to collect more information on the methyl mercury to total mercury ratio in the sediment at different times of the year and after storm events when sediment would be stirred up. Alternately a simulation of sediment stirring could be done in the lab. This will need to be part of the CMS since dredging can make the mercury more available.

Comment: 20

The PMPS for sediment must be revised to reflect the State of Maine's legally enforceable ambient criterion to protect human health from mercury in fish tissue. The 3.2 ppm number is based on the 0.3 ppm EPA fish tissue action level rather than Maine's 0.2 ppm fish tissue water quality criterion, which is in statute under 38 M.R.S.A. Section 420, subsection 1-B, paragraph A(2). The 0.2 ppm number is scientifically valid and strongly supported by the Maine Bureau of Health. This number will also eventually be used in deriving criteria for mercury levels in water that are protective of human health and dischargers to state waters will be required to meet these numbers. There is simply no reason to use a less stringent federal standard for cleaning up a site in Maine for which Maine DEP will eventually assume jurisdiction. Use of the 0.2 ppm criterion would result in a one-third stricter cleanup level for sediments than the 0.3 ppm action level. (NRCM)

Response:

The agencies agree with the commentor that the 0.2 fish tissue action level is appropriate for use in this situation. The PMPS for the Penobscot River, Southerly Cove was changed to 2.2 ppm. This value is derived using the State of Maine 0.2 fish tissue action level.

Comment: 21

The use of an average level for sediment cleanup is potentially problematic. The agencies will have to strictly oversee the development of the cleanup sampling grid in order to ensure that "clean" areas are not over-represented. (NRCM)

Response:

The agencies agree that the key to cleaning up the sediment in the Southerly Cove is dependent upon an appropriate sampling grid. It is not the agencies intention to allow lower contamination areas to be averaged in with higher contamination areas in order to achieve the clean up standard. To further clarify this, a narrative PMPS (see Section IV) was added that requires the removal of each of the two heavily contaminated areas to minimize the concern that these areas would not be removed. In addition a sampling plan will be required to confirm that the clean up standard has been achieved in an appropriate fashion and not through including less contaminated areas to mask areas that need to be removed. As we reach the clean up stage and design the sampling plans that do incorporate averaging, members of the community will have an opportunity to see exactly how it is being used.

Comment: 22

Against the use of averages, they can smear pretty bad stuff. (Person)

Response:

See above response.

Comment: 23

Concern with the use of averages because do not want to be near high levels just because the overall average is ok. (Hessel)

Response:

See above response to comment #21.

Soils

Comment: 24

It is appropriate that the soil PMPS for mercury be the same as the sediment PMPS given the likelihood that soil will erode into the Penobscot River over time. (NRCM)

Response:

The agencies agree. In addition a narrative PMPS was added to address the erosion issues to minimize movement of any contaminated soils to the Penobscot River.

Comment: 25

It is unclear whether the 3.2 ppm PMPS for soils applies to the landfills or not. The Council believes that whatever PMPS is chosen for soils, it should apply to the landfills and landfill materials. (NRCM)

Response:

The soil PMPs of 3.2 ppm, now 2.2 ppm, was not intended to include the waste sludges within the landfills. The agencies view the landfill contents not as a soil, however the CMS should evaluate these landfills for long term suitability. These landfills are all capped and if properly maintained would not erode into the river or pose a contact issue with ecological wildlife or humans. Landfills remaining on site will be maintained and monitored as a part of the post closure activity of the site to ensure that erosion and leaching are not polluting the river.

Comment: 26

The sediment number should also apply to the landfills. (MPA)

Response:

See above response.

Comment: 27

The soils PMPS should also apply to the landfills. Concerned with the landfills and soils leaching into the river in the future. (Kpear)

Response:

See response to comment # 25.

Surface Water

Comment: 28

The PMPS for surface water must be revised to ensure compliance with the State of Maine's ambient criterion to protect human health from mercury in fish tissue. The 0.91 ug/l standard will not meet Maine's 0.2 ppm fish tissue water quality criterion (or, for that matter, the EPA 0.3 ppm fish tissue action level). Typically, when choosing from a number of criteria in a discharge situation, the most stringent criteria are applied. Why have EPA and DEP not done so in this case? In addition, the agencies state that a 0.91 ug/l PMPS must not result in the lowering of existing water quality in the Penobscot River. However, the Council does not see how a discharge of 0.91 ug/l could not lower existing water quality in the Penobscot. Such levels of mercury discharge would be far higher than any industrial facility in the state. Current mercury levels in on-site surface water being discharged to the river, as high as 36 ug/l, are also a concern for Penobscot River water quality right now. (NRCM)

Response:

The agencies believe that the interrelationship of the different factors is not clear from the PMPS table. For this reason a narrative PMPS was added that makes it clear that interception of contaminated water heading to the onsite surface water will be necessary. In addition once the time comes to cease the interception mechanism, Mallinckrodt would need to make a demonstration that: (1) any fish present in the onsite surface water meet the 0.2 fish tissue action level or are not significantly elevated over two other appropriate reference sites and that (2) if the onsite surface water were at .91 ug/l that no significant lowering of the Penobscot

River water quality would occur. This is consistent with the Maine Water Quality Criteria for Mercury that requires compliance with both the .91 ug/l level and the fish tissue action level. The .91 ug/l was utilized in the onsite stream because this is the value that is appropriate for the protection of directly exposed aquatic biota. In addition since no waterbody in Maine meets the fish tissue action level, applying best management practices to this situation is appropriate and in keeping with the legislative intent. As a practical matter, the intent is to prevent mercury from reaching the onsite surface waters, which is what the narrative standard requires.

Comment: 29

The 0.91 ug/l standard does not protect for mercury effects on or bioaccumulation by reptiles and amphibians. These animals are likely to be present in the onsite streams even if fish are not. (NRCM)

Response:

The one remaining possibility would be to calculate a number based upon resident amphibians and reptiles, which are, believed to utilize the onsite surface water. However the agencies are unaware of data that would allow us to calculate such a value.

Comment: 30

It is unclear why the freshwater chronic criteria of .91 ppb versus the .012 ppb value is being used for onsite streams. If it were because the stream can not support fisheries, then it would be helpful to clarify that in the PMPS basis. (Rand)

Response:

The .012 ppb is an old 1984 EPA freshwater chronic criteria value. In 1998 and 1999 (corrections) EPA updated this value to its current value of .91 ppb. The .91 ppb value is based upon the Great Lakes Initiative work and represents current thinking on the appropriate number. See the above response to comment #28. In addition Section V of this document explains the basis for the various PMPSs.

Groundwater

Comment: 31

The 2.0 ug/L PMPS for ground water must be revised to ensure compliance with the State of Maine's ambient criterion to protect human health from mercury in fish tissue. This is the same issue outlined above for surface water. The agencies have assigned a PMPS of 2.0 ug/l for ground water but also state the ground water discharged from the site must not result in a significant lowering of water quality in the Penobscot. However, as stated above, the Council does not understand how such a cleanup level could fail to result in the lowering of existing water quality in the Penobscot given the nature of the topography and the flow of ground water from the

site to the river. The agencies should provide more explanation on this issue. (NRCM)

Response:

The 2 ug/l groundwater PMPS will require that the entire plume of mercury contaminated groundwater from the plant area, the brine process lagoon area and landfill area #1 will be collected and treated prior to discharge to the river for several decades. The 2 ug/l PMPS will come into play when the operators of the treatment system request to discontinue treatment. At that time regulators and citizens will determine whether discontinuing the treatment system would lower the water quality in the Penobscot River. Knowledge of the mercury budget of the river and the importance of the contributions from groundwater at HoltaChem will likely be much improved by the time this decision needs to be made.

Corrective Measures Study (CMS) Workplan comments:

General

Comment: 32

I believe the CMS work plan outlines an approach to developing corrective measures that should allow for a technically sound and balanced evaluation. The methodology and evaluation criteria are similar to those used at other contaminated sites in Maine.

The moderate and high concentrations of mercury at and adjacent to the site provide an opportunity to remove and control/reduce future mercury discharges with manageable disturbances to ecological habitat and site environs. I believe now is the time for efforts and resources to be focussed on this remedial opportunity as outlined in the CMS work plan. The lower levels of mercury distributed up and down the Penobscot River represent a different management challenge, which the court ordered down river study will address. (Rand)

Response:

The agencies agree that moving forward with the CMS process is appropriate at this stage. Any results from the court ordered downriver study would be assessed at the time the data is available.

Comment: 33

Given the likelihood that soil will erode into the Penobscot River over time. Recognition of this fact on the part of the agencies underscores the point made under general comments above that adequate consideration continue to be given to excavation and removal remedies. (NRCM)

Response:

The agencies agree that the CMS workplan needs to be modified to specifically include as one of the options for evaluation, the excavation and removal of the onsite landfills on a landfill by landfill basis.

Comment: 34

We need absolute assurance that this site, at some point in the future, can be used for something other than a lasting monument to short-sighted business practices. The cleanup must be so thorough that we can expect to attract new commercial or industrial enterprise to it, in order to rebuild our tax base. The site should be clean enough, in fact, that it will attract a clean and progressive industry, willing to take responsibility for being a good neighbor, not just another dirty industry that can not find any other town willing to accept it. (Rjudd)

Response:

The agencies intend to have a cleanup that makes the site protective of public health and the environment. It is however impossible to clean all contaminants from the site. As with many of these types of sites, protective engineering controls, deed covenants and ongoing monitoring and remediation will be necessary. The agencies do believe however that the majority of the site will be available for reuse in the future. The portions available for reuse should have access via route 15 and the railroad line.

Comment: 35

Remove all of the toxics from the site and the Penobscot River. A thorough and complete clean up is the only acceptable solution. (Pjudd)

Response:

The agencies believe that the complete removal of toxics from the site and the Penobscot River is not possible. It is however the intent of the agencies to select PMPSs that will represent the best balance of protecting public health and protecting the environment.

Comment: 36

Orrington made a mistake decades ago. Had a chemical plant and it leaves and surprise, surprise, they leave chemicals behind at the site. Doing nothing is not an option. Would you want to put a business on that site. Lot of confusion about what the true facts are. What is dangerous and what is not.

If stories I hear are true that they dumped waste into mining shafts and unlined landfills. Have got to get it out, get it all out - out of the ground, out of the building, sweating of mercury from building, out of the river.

Embarrassed of hometown that it got an exemption to dump mercury into river. Do not ship the mercury to India, store it in proper containers, retire it. (Bahr)

Response:

The agencies agree that it must be difficult to understand what the "true" facts are for this site. There have been a number of statements made at public meetings and in news reports that have at best been misleading. In a simple version of the facts, the HoltraChem site is contaminated by a number of contaminants through use of the site as an industrial property since 1967. The primary contaminant is mercury, although there are other contaminants of concern at the site. Chloralkali plants have historically used mercury to produce their products. All of these chloralkali plants have mercury contamination. Several of them are also in the process of being investigated and remediated. The situation in Maine in terms of contamination is quite similar to the plants in other states. The Maine plant investigation appears to be as far along or further along than most of the other plants in the United States. The air around the Maine plant has been investigated more thoroughly than has been done at other US chloralkali plants that the agencies are aware of. It has only been in the last few years that the technology has existed to monitor ambient levels of mercury at lower levels. Once this technology was available the Maine DEP required HoltraChem to use it to monitor the mercury emissions from the plant. See response to comment #52 for a discussion of the air emissions from the plant.

While the contaminants are different between the different types of industrial plants, industrial plants do generate waste as a part of their operation. The operation of this plant generated among other things mercury containing waste. In the case of this waste, as was typical of industrial plants during that era, the waste was disposed of for a number of the early years in onsite landfills. At the first part of the plants operation, until US EPA discovered it, waste was piped into the Penobscot River. This was believed to have begun in December of 1967 when the plant began production until it was stopped as a result of the agency inspection in mid 1970. The types of units that were utilized at the site for waste disposal were landfills and gravel pits/excavations. No mining shafts exist onsite and therefore no waste was disposed of in a mining shaft. The following onsite units were used for waste disposal:

- Mac's Pond, an excavation pit, used from approximately mid 1970 to 1971;
- Landfill 1A and 1B, a landfill in the area of Mac's Pond, used from approximately 1971 to February 1972;
- Landfill 3, a landfill on the ridge behind the plant area, sludge from Mac's Pond was moved to this landfill, used from approximately 1971 to mid 1972;
- Landfill 2, located upgradient of the plant near the old quarry, used from approximately September 1972 to sometime later in 1972;
- Landfill 4, located adjacent to landfill 3 on the ridge behind the plant area, used from approximately 1972 to early 1980;
- Landfill 5, located adjacent to landfill 4 on the ridge behind the plant area, used from approximately 1978 to September 1983.

All of these landfills were built prior to Federal or State authority to regulate hazardous waste and as such were built to the industry standards of the time,

which did not include liners. Over the years all of the landfills were either excavated and relocated into another onsite landfill or were covered with a cap. The caps vary from soil caps to synthetic caps. As a part of the CMS process, Mallinckrodt will need to evaluate the long term suitability of these landfills taking into account the lack of liners, the nature of their caps, and the elevation and flow of groundwater.

The site soils and groundwater are contaminated with among other contaminants, mercury. The groundwater discharges to onsite surface waters and into the Penobscot River. The site soils do erode and move into onsite surface waters. The Maine DEP required HoltraChem to install a groundwater capture and treatment system that prevents groundwater from discharging into the Southerly Stream and prevents the groundwater from moving toward the Ferry Road properties. The Maine DEP also required HoltraChem to take measures to prevent the movement of soils into onsite surface waters. These measures include industrial sweepers of the paved areas of the plant, sediment filters in the catch basins, which trap sediments, and vegetation of exposed soils to prevent erosion. The other major area of groundwater discharge along the river side of the plant is planned to be captured and treated. Any areas of contaminated soils onsite are planned to be capped to prevent movement and to reduce infiltration into the groundwater beneath the site.

The buildings that are contaminated with mercury or that are no longer needed are planned for removal. This includes buildings that have mercury at levels that result in "sweating" of mercury out of the concrete and other structures. This is why the agencies have continuously expressed the need to move the 84 tons of mercury so that the dismantling of the buildings could begin.

The river contamination is much more problematic to deal with. First because it is more difficult to remove and the technologies will result in some amount of resuspension of sediments. Some of this resuspended sediment will move out of the area being dredged. As a part of the CMS, different techniques will be evaluated to pick the best method but we have no expectation that complete containment of resuspended sediments will be possible. Secondly the amount of area disturbed effects the analysis of the advantages and disadvantages of sediment dredging. With the exception of the cove directly adjacent to the site, the river sediments while elevated, are not highly elevated. The lower Penobscot River has a mercury concentration of around 1.16 ppm (average of CDM and NRDC data) as opposed to .59 ppm for upstream sections of the river (above the Bangor dam). Because the concentrations are not highly elevated, it is questionable whether 24 miles of river should be dredged to remove these somewhat elevated mercury sediments. This is ultimately something that each citizen will need to think about in terms of whether they think the proposed clean up is the best approach. Thirdly while the sediments are somewhat elevated and there is a correlation between forage fish (killifish) mercury concentrations and the sediment near where they reside, it is a small one. Approximately 1% of the

mercury in the sediment appears to be making it into the killifish and by the time it makes it to the predator fish (eels), the eel mercury concentrations are essentially indistinguishable from eels from other rivers in the state. These facts make it difficult to require dredging many miles of river with the resulting damage to habitat. Fourthly much of the decision for whether to dredge the many miles of river depends on the data collected. Much has been made of whether the correct sample locations were chosen and whether too many of the samples were taken near the site. One allegation was even made that most of the samples were taken upstream of the site. The fact is that there are two sets of sediment samples that were used to determine the river conditions. The first set of data is the sediment work conducted by CDM, Mallinckrodt's consultant. These sample locations were designed to take samples from the most likely areas of high mercury contamination, i.e.: those depositional areas closest to the site and the two wide, flat depositional areas downstream which are also in the area of transition from river to estuary. The agencies believe that it is these later areas where contaminants are most likely to settle out. Even in the wide flat areas downstream (Frankfort Flats and Fort Point Cove), the sediment samples were not highly elevated. The CDM samples consisted of 76 locations, excluding those taken in the Southern and Northern Coves near the facility. There were 19 locations (31 samples) taken upstream of the site, 321 samples taken at the site, 31 locations (56 samples) taken nearer to the site (within 4 miles of the site downstream), and 26 locations (33 samples) taken from the two wide flat depositional areas and one ledge area in the channel from 10 miles to 22 miles downstream from the site. In addition the Natural Resources Defense Council (NRDC) data was also evaluated. This second set of data consisted of 18 sample locations, 2 taken from upstream of the site, 2 taken from near the HoltraChem facility, 2 taken from within 4 miles downstream of the facility, and 12 taken from the section from 10 to 22 miles downstream of the site. The total number of sample locations taken from the river when combining the two sets of data were 94 locations, excluding the Southern and Northern Cove samples. None of the data outside of the Southern Cove showed highly elevated levels of mercury in sediment (maximum was 3.3 ppm of mercury), certainly nothing approaching the levels found in the cove directly off the site (maximum of 460 ppm of mercury).

The exemption that allowed this site to continue discharging mercury into the Penobscot River was put into legislation on September 24, 1971. It was part of an overall progressive water quality law designed to eliminate the discharge of mercury into Maine's waterways. While this occurred well before the time of the agency staff currently working on this site, it is not hard to envision that this was at the time a difficult decision for the Maine Legislators since it did effect other major employers in the state. Since the law without the exemption would probably have meant that the chloralkali plant would need to go out of business with the resulting loss in jobs and tax base for the town, we suspect that lobbying to get the exemption was probably intense and may even have been supported by the local residents at the time. Older individuals in town could probably provide more insight into this issue. To our knowledge the legislation, which became

effective on July 9, 1998, to ratchet down the discharges and emissions of mercury from this plant are unique to Maine. We do not believe that any other state has tackled this difficult issue. By way of perspective the US EPA allowed almost 2,000 pounds of mercury to legally be emitted from a chloralkali plant per year. Maine's law ultimately limited emissions to 100 pounds per year.

Mallinckrodt, the Natural Resources Council of Maine, Mercury Waste Solutions of Wisconsin, and the agencies all worked to get a retirement solution for the 84 tons of mercury in container storage at the HoltraChem site. This was finally accomplished in early September of 2002. The three primary parties (Mallinckrodt, Natural Resources Council of Maine and Mercury Waste Solutions) should be commended for achieving this first in the nation storage of mercury while awaiting a federal mercury retirement policy. We are aware of no other facility in the United States that has implemented a pre retirement storage plan.

Landfills

Comment: 37

The unlined landfills on this site must be thoroughly taken care of; they must not be left on site where they will continue to add mercury to the Penobscot River for decades. (MPA)

Response:

The agencies have modified the CMS workplan to require the consideration of excavation and removal of one or more of the onsite landfills. Realistically it is however unlikely that the complete removal of the landfills will occur from the site. It should be noted that due to the volumes and variety of materials typically contained in landfills, US EPA's presumptive remedy for landfill control is capping to prevent direct contact with the waste and to limit the generation of leachate.

Comment: 38

We have got to remove it to a safe place where it can be truly entombed forever. It is already leaching from one area of high contamination into streams, and riverbank erosion is attacking another. If we just cover it up on site it will eventually leach out into the river and into the food web. (MPSR)

Response:

The agencies have modified the CMS workplan to require the consideration of excavation and removal of one or more of the onsite landfills. See also response to above comment.

Comment: 39

Given its location near a very large river and the evidence of both leaking (landfill 2) and erosion (Landfill 1), the Council does not believe that the HoltraChem site is likely to be particularly stable, and long-term storage or disposal of mercury-contaminated waste at this site may be inappropriate. We therefore urge that the agencies be sure to continue to consider cleanup options that will result in the removal of all the toxic materials from the site. (NRCM)

Response:

The agencies have modified the CMS workplan to require the consideration of excavation and removal of one or more of the onsite landfills. See also the response to comment # 37 above. This commentor may also be referring to the construction of a new Corrective Action Management Unit (CAMU) onsite. The concept for a CAMU will also need to be evaluated during the CMS process. This process will need to look at the issue of long-term entombment onsite for various wastes generated during clean up versus offsite disposal or treatment.

Comment: 40

First, we must be absolutely satisfied that no more mercury will leach into the river, either from contaminated surface soil or from the existing landfills on the site, which are presently leaking. (Rjudd)

Response:

The agencies cannot assure the public that no atom of mercury in the soils or in the landfills will ever reach the river. The objective of the CMS is to evaluate site specific characteristics such that a remedy can be designed to make sure that the amount of mercury reaching the river is small compared to the river's natural mercury budget. Technology is available to prevent mass transport of mercury from the site to the river, which would adversely impact the river ecosystem.

Comment: 41

We must be absolutely satisfied that all mercury and mercury-contaminated soils and sediments have been removed from the site. This includes the several tons of mercury remaining in the plant's vats. Safe, long-term storage-again, over several generations – is a problem of enormous technical complexity and high capital costs. Any make-shift attempt at on-site storage is bound to cause trouble further down the road. We do not want to go through this nightmare again. (Rjudd)

Response:

The last of the mercury in storage at the site was removed to a long term storage location on September 6, 2002. Removing all mercury contaminated soils from the site will not however be possible. The five landfills onsite will be evaluated for possible removal during the CMS process. The agencies agree with the commentor that the long term monitoring and maintenance of contamination is less preferred to a pristine site, however as with many of these contaminated sites we can rarely put them back to a pre industrial condition. In these situations the protection of public health and the environment is accomplished by containing,

treating and monitoring the contamination to control the site as a source of significant contamination and prevent exposures to unhealthful concentrations of contaminants.

Mercury Storage

Comment: 42

In November 2001 Orrington gathered to consider three options regarding the stored mercury. At that meeting it was unanimous that residents wanted 84 tons removed from Orrington. The majority of those residents wanted that mercury in commercial storage for a period of time to allow the formulation of some type of federal guidelines for permanent retirement of mercury. Residents thought it would have happened by now, residents saw this as an impediment to the progress of clean up. Ask for mercury to be removed so site can be cleaned up. (TM)

Response:

The agencies are happy to report that the last shipment of the 84 tons of mercury was moved from the site on September 6, 2002. It went to a facility for storage for several years (four years with extension ability for an additional four years) to allow the formulation of a federal mercury retirement policy. While the negotiations took longer than expected, it was accomplished in no small part due to the good will of the Natural Resources Council of Maine and Mallinckrodt.

Comment: 43

Same concerns as the Town Manager. Mercury should be out of site or in storage. Seen studies for past few years, nothing has been done. Need to have it moved, not stand around. (Boudreau)

Response:

See above response.

Comment: 44

Get rid of the 82 tons of mercury. (Person)

Response:

See the response above to comment #42.

River Assessment

Comment: 45

I think you must do a very thorough assessment of mercury down river from Bangor to the Flats, and if mercury is there, all the way out into Penobscot Bay. And especially near our house which is located on one of the widest points on the lower Penobscot. Surely any pollution bearing sediment would settle there after being

scoured from the bottom near the plant where the deep water, which makes it such an ideal industrial site, is also very fast and surely also must flush mercury into the sediment miles downstream. It should include a large enough number of samples to thoroughly map the area, and go down as deep as needed to represent HoltraChem's pollution over its entire lifetime. I find it hard to believe that mercury is not present in high levels in the deeper sediments there, and has probably been washed upwards by strong tides toward Bangor as well. (MPSR)

Response:

The sites that were sampled in the river were those expected to have the highest levels of mercury. This is called biased sampling as opposed to random sampling where you do not try to obtain the highest levels. The reason the agencies believe the most appropriate locations were sampled is that the sites are: first of all depositional areas which are areas where sediments naturally settle out; two, are the depositional areas closest to the site which would be the first areas where sediments would accumulate in higher concentrations because they are closest to the high source (the cove off of the site) and would therefore be less likely to be diluted; and third, the next flat, wide depositional areas which are also in the transition between river to estuary environment which are the most likely settling point for upstream sediments. The upper sediments were sampled downstream because this is the level that is most available for uptake.

The court ordered down river study presumably will consider issues such as those identified by the commentor and more data will be collected. The results of the study will be assessed at that time, which is currently expected to be from three to five years from the beginning of the study. See also response to comment #17 above.

Comment: 46

The testing for the mercury in the Penobscot was done in such a way as to use an average of those sites tested upstream and downstream of the former HoltraChem site. This means the cleanup will not be done in a positive way, if these averages are used to figure out where to clean, especially since the upstream test sites do not truly and fairly represent the actual damage and thus throw off any calculation based on such an average. The testing needs to be re done using real values from each site, not an average. The clean up needs to be based on the new testing numbers, that reflect actual amounts of damage and contamination not averages. (Silber)

Response:

The agencies believe that this commentor thinks that sediment values were composited between sites. This is not the case. In order to obtain a representative sample at any given sediment location several samples will be taken from the same sample core. This is a standard sampling technique designed to obtain a truly representative sample.

Further if the concern is that the PMPS is an average value, the sample results from the two areas with the highest concentration of mercury will not be averaged with the results of samples from areas adjacent to the two "hot spots". See attachment 3 for general location of hot spots.

Comment: 47

The cleanup needs to occur in ways that actually clean up the mess, not in ways that make it easier and cheaper for the former owners. We citizens of Orrington need to know the cleanup is happening in a way that eventually helps the river and it is banks to eventually recover from this disastrous mess. As long as the clean up is based on flawed techniques involving average of the actual numbers, we will never get a full cleanup. (Silber)

Response:

The agencies agree that the cleanup needs to be done in an appropriate manner, at the same time we also need to be realistic about what is technically feasible and protective of public health and the environment. The CMS will evaluate different options for dealing with the contamination. During this process the pros and cons of the different solutions will be evaluated. The proposed remedies from this evaluation will be open to public review and comment.

Lake Studies

Comment: 48

Depositions downwind of sites, what is the background values in the lakes? (Person)

Response:

Evidence of impacts on downwind lakes upon closer evaluation has not been tied to HoltraChem. The conclusion of the most recent study determined that the specific lake characteristics were more of an indicator of whether a lake had high mercury levels than whether it was downwind of HoltraChem. The sediment corings from these lakes also did not see an increase in mercury deposition that was associated with the start up of the HoltraChem plant when the highest mercury emissions were believed to occur. Likewise as the plant phased down emissions and finally closed, there was no evidence of a decrease in local deposition. Instead according to the university researcher who conducted the study, the mercury deposition rates in lakes around HoltraChem are similar to that found state wide, both in timing and magnitude.

Comment: 49

Tons of air emissions have gone into the air, these need to be addressed in the clean up. (Defran)

Response:

While the HoltraChem facility has had air emissions of mercury and other compounds, the actual amounts are not possible to accurately estimate due to the nature of the process and the scattered points of emissions from the cell room. Ambient sampling conducted prior to the facility shutting down did not record high levels of mercury off the facility property. It appears that the majority of the emissions were deposited on the facility property. Small amounts may have left the HoltraChem property and have entered the global mercury pool but it would be impossible to identify and track where those emissions may have gone. See also the response above.

Comment: 50

In the downwind lakes from HoltraChem, three frogs were found in the cove, two were dead. Wonder about the effects of swimming, eating fish from lakes downwind of the site. (Free)

Response:

There is a fish advisory for the state including all of Maine not just the downwind lakes from HoltraChem. Residents should comply with these advisories for their protection irrespective of any deposition from the HoltraChem emissions. See also response to comment # 48 above.

Soils

Comment: 51

There should be greater characterization of soil at depth including near underground piping. (NRCM)

Response:

The agencies agree that further work is necessary during the CMS phase for the onsite sewer and pipelines, at the back of the landfill ridge, and most likely under the cell building. Characterization in the plant area already shows us that we have areas that need to be addressed. Work at other chloralkali plants attempt has not been successful. Instead the agencies intend to require removal, investigation of areas under the cell building and piping. However at other areas additional sampling is not needed unless it is exposed to groundwater and is outside the groundwater capture zone or in some way the soil is disturbed. Confirmation sampling will be necessary to confirm that the scraped and capped areas capture all soils in need of management, ie: those over 2.2 ppm of mercury.

Air Emissions

Comment: 52

The air emissions from the site are a large gap. What if anything has been done to determine what the air emissions were and what they currently are? (Person)

Response:

Ambient sampling was conducted prior to the shutdown to determine what, if any, impact emissions were having on nearby neighborhoods. Sampling will also be conducted during the clean up process to determine what impacts the emissions are causing in the local area and to ensure that unacceptable emissions are not created. In addition activities that have potential to produce significant mercury emissions will be required, as much as possible, to be timed to times of the year that minimize emissions, such as cooler times of the year. See also response to #49 above.

Comment: 53

Concerned with the air emissions from the plant in the past. (Lee)

Response:

The agencies share the commentor's concern. This is why the Maine DEP required emissions testing as a part of their air license and why the Maine DEP approached the legislature about reducing the allowable emissions from the plant. The emissions from the plant were probably quite high in the early years of its operation. In later years the emissions are believed to have been reduced by operational changes at the plant. See also the response above.

Health Assessment

Comment: 54

ATSDR said at the last meeting that humans could be tested for mercury. This should be done. (Lee)

Response:

The ATSDR is in the process of gathering information to determine whether they will be able to conduct a health assessment. They have been in contact with the agencies regarding the available information and have been working with the Maine State Toxicologist on the initial review of the available data.

Waste Handling

Comment: 55

I wanted to add reference to WABI TV Assistant News Director Rick White's statements of May 14, 2002 to me. On that day, he alleged that HoltraChem was "Maine's dirty little secret". He said that with Bangor and Aroostook Railroad company knowledge, paper mills would send railcars loaded with hazardous waste to the HoltraChem plant where they would be parked overnight and mysteriously emptied by morning. The cars would then be loaded with chlorine from the chemical plant and returned to the paper mills. He did not say what paper mills were involved

but did indicate that illegal dumping also occurred at the Sawyer landfill in Hampden. (Leslie)

Response:

The agencies have requested Mr. White's assistance in responding to this allegation. Based upon these discussions, the agencies believe that this is an unfounded local rumor that apparently has been circulating for close to 15 years. Mr. White further stated that had there been truth to the rumor that his or another news organization would have been able to verify facts that would support the rumor. They have been unable to do so.

Closure/ Remediation Actions

Comment: 56

Furthermore, previous exposures would reasonable sensitize the human system to additional exposures such as uncontrolled releases at closure. (Leslie)

Response:

The agencies agree that an air testing system for monitoring mercury emissions is necessary for the site remediation. The air PMPS provides an appropriate standard for protecting public health from any releases from remedial activities.

Comment: 57

Andy Smith, the State Toxicologist, said that any disruption of mercury contaminated soil or buildings must be done in an enclosed system to prevent volatilization from contaminating the air. Any clean up of the site should follow this protocol and have some type of oversight by public health officials. (Leslie)

Response:

The agencies are very concerned that the remediation be done in a manner that will not cause the ambient air guideline to be exceeded off the site. Air monitoring will be conducted during remediation. Mallinckrodt has already been pursuing this issue and investigating what instruments and control measures are available to accomplish this task. The ambient air monitoring plan for the remediation will be placed in the Town Library in the HoltraChem repository and will be available for public review.

Interim Action comments:

Groundwater Measures

Comment: 58

File materials indicate that the groundwater at and downgradient of the lined lagoon/landfill 1 area is a significant route of mercury export from the site (5.8

kg/year = 13 pound per year). While the CMS will be based on a groundwater barrier and extraction/treatment system, the timeline for construction of this system has not been indicated. With groundwater treatment presently occurring at the site, an opportunity exists to implement an interim groundwater collection system. A simple groundwater collection system could be configured at low cost and would provide valuable treatability/disposal information for use in the CMS. Noting that the RCRA corrective action process supports and includes interim measures, it is recommended that EPA, DEP and Millinckrodt consider such an interim measure. (Rand)

Response:

The agencies agree that implementing groundwater collection and treatment in the area just downgradient of the industrial plant, in the vicinity of Landfill #1 is necessary. This pathway contributes a significant amount of mercury to the Penobscot River. Partial capture of this groundwater as an interim action is preferable to waiting several more years for full scale implementation. This action has been required of Mallinckrodt as an interim action.

Comment: 59

Agree that interim measures should be taken to control the contaminated groundwater such as Mr. Rand suggested. (Person)

Response:

See above response.

Court Case comments:

Comment: 60

The commentator submitted copies of the United States District Court decision Civil No. 00-69-B-C (34 pages), Plaintiffs' Proposed Findings of Fact and Conclusions of Law (26 pages), Plaintiffs' Responsive Post-Trial Brief (21 pages), Plaintiffs' Opening Post-Trial Brief (51 pages) into the record without specifying what changes to the PMPS or CMS workplan the commentator desired. (JDK)

Response:

The commentator made no specific request for changes to either the PMPSs or the CMS workplan. It is unclear to the agencies what change to either document the commentator intended to occur from entering these items into the record.

IV. Preliminary Media Protection Standards (PMPS)

The agencies, after consideration of public comment, approve the below as the PMPS for the HoltraChem site.

A. Numeric Standards

Table 1
Numeric Preliminary Media Protection Standards

Constituent

Media	Mercury	Manganese	Acetone	Chloro- picrin	Chloro- form	Carbon tetrachloride	Hexa- chloroethane	Penta- chloroethane	m-cresol	p-cresol	PCBs	TCE
Groundwater	2.0 ug/L ¹	500ug/L or ² background	700 ug/L	30 ug/L	57 ug/L	3.0 ug/L	7.0 ug/L	13 ug/L	35 ug/L	3.5 ug/L		5.0 ug/L
Surface Water (on-site)	0.91 ug/L ³				57 ug/L	3.0 ug/L						
Surface Water (Penobscot R)	background											
Sediment (on-site)	2.2 mg/kg											
Sediment (Penobscot R. in Southern Cove)	Average: 2.2 mg/kg Averaged areas .less than 1/4 acre in size											
Soil	2.2 mg/kg			.125 mg/kg							1.0 mg/kg	
Air	.31 ug/m ⁴											

1. At achievement of this PMPS it must be demonstrated that surface water PMPS is being attained or that untreated ground water discharge will not significantly lower the existing water quality. If one or the other of these conditions cannot be demonstrated ground water capture and treatment will be continued. In addition Maine's fish tissue residue standards needs to be assessed for attainment prior to shutting the ground water treatment system down.
2. All background values referenced in this table will be established during the Corrective Measures Study. Background values must also be established and met for conductivity, salinity, alkalinity, and pH in surface water and ground water.
3. The surface water standards for mercury are for total metal values (particulate plus dissolved), not dissolved metals. Discharge at this level must also be documented to not significantly lower the existing water quality and that fish meet the fish tissue residue value or for onsite fish are not significantly elevated over two other reference sites.
4. The air standard is a 24 hour averaged value at the property line and a not to exceed value (i.e. air monitoring readings must remain below .31 ug/m³) at points of offsite exposure.

Table 1
Numeric Preliminary Media Protection Standards

Constituent								
Media	1,1 dichloroethane	1,1 dichloroethene	Cis 1,2 dichloroethene	Trans 1,2 dichloroethene	Carbon disulfide	Bromo form	Methylene Chloride	bromodichlororo methane
Groundwater	70 ug/L	0.6 ug/L	70 ug/L	100 ug/L	600 ug/L	44 ug/L	5.0 ug/L	6 ug/L

Table 1
Numeric Preliminary Media Protection Standards

Media	Constituent					
	dibromochloromethane	2,4, 5 -T	Cadmium	ethylbenzene	xylene	Tetrachloroethene
Groundwater	4 ug/L	50 ug/L				5 ug/L
Soil			8 mg/kg	13 mg/kg	190 mg/kg	

B. Narrative Standards

Sediment (Penobscot River) - The two highly elevated areas of mercury contamination will at a minimum be removed. Sampling numbers (RSC 009, RSD 015H, RSD 015G, RSD 015E, RSD 016A, RSD 016B, RSC 012, RSC 020, RSC 010, RSD 015F, RSD 015B, RSD 015A, and RSD 015C) and (RSC 024, RSD 011C, RSD 010A, RSC 019, RSC 018, RSD 010B, RSD 010C, RSD 011A, RSD 011B, RSD 011G and RSD 011F) represents these areas.

Soil - All soils onsite and adjacent to the site that may contain mercury greater than 2.2 ppm must be vegetated, paved or otherwise stabilized to prevent erosion. In addition an industrial sweeper will be utilized on all parking lots, roadways and other paved areas each spring to collect any potentially contaminated soils. All catch basins shall contain "socks" to filter and collect any potentially contaminated soils or sediments. These socks shall be removed and cleaned or replaced periodically to maintain their effectiveness.

Surface Water - Areas of mercury contamination will be collected for treatment and will be prevented from entering the onsite surface water. At such time as Mallinckrodt believes that no further treatment is warranted, they will need to make a demonstration that: (1) the resident fish in the onsite stream meet the 0.2 fish tissue residue value or that the level is not significantly elevated over two appropriate reference sites, (2) the .91 ug/l level will be achieved in the onsite surface waters, (3) a discharge at the .91 ug/l level, or such lower level as may be present, and in the quantity present in the onsite surface water will not significantly lower the Penobscot River water quality, including during storm events (4) and a discharge at that level and quantity will not adversely affect the fish tissue levels in the Penobscot River.

V. Basis for Preliminary Media Protection Standards

Air:

Mercury:

Maine Ambient Air Guideline.

EPA reference concentration, which is a peer reviewed value on the Integrated Risk and Information System (IRIS) database.

Groundwater:

Mercury:

2.0 ug/l:

Federal Maximum Contaminant Level.

Maine Maximum Exposure Guideline.

Surface water PMPS is attained or any discharge of groundwater will not significantly lower the existing water quality and the fish tissue residue standard is assessed for attainment prior to shutting groundwater treatment system off.

State Ambient Water Quality Criteria (AWQC).

Ambient Criteria (AC).

Manganese:

Maine Maximum Exposure Guideline or background.

Acetone:

Maine Maximum Exposure Guideline.

Chloropicrin:

Site Specific Risk Based derived value.

Chloroform:

Maine Maximum Exposure Guideline.

Carbon tetrachloride:

Maine Maximum Exposure Guideline.

Hexachloroethane:

Maine Maximum Exposure Guideline.

Pentachloroethane:

Site specific risk based derived value.

m-cresol:

Maine Maximum Exposure Guideline.

p-cresol:

Maine Maximum Exposure Guideline.

Trichloroethene:

Federal Maximum Contaminant Level

Tetrachloroethene:

Federal Maximum Contaminant Level

1,1 dichloroethane:

Maine Maximum Exposure Guideline.

1,1 dichloroethene:

Maine Maximum Exposure Guideline.

Cis 1,2 dichloroethene:

Federal Maximum Contaminant Level

Maine Maximum Exposure Guideline.

Carbon Disulfide:

Maine Maximum Exposure Guideline

Bromoform:

Maine Maximum Exposure Guideline

Methylene Chloride:

Federal Maximum Contaminant Level

Bromodichloromethane:

Maine Maximum Exposure Guideline

Dibromochloromethane:

Maine Maximum Exposure Guideline

2,4,5 - T:

Maine Maximum Exposure Guideline

Conductivity:

Background.

Salinity:

Background.

pH:

Background.

Sediment (onsite):

Mercury:

Site specific risk based derived value that is protective of humans and wildlife that consume bottom dwelling organisms in sediment in the cove in the Penobscot River and that is based on a dietary level of 0.2 mg/kg.

Sediment (Penobscot River):

Mercury:

Average of 2.2 mg/kg:

Site specific risk based derived value that is protective of humans and wildlife that consume bottom dwelling organisms and that is based on a dietary level of 0.2 mg/kg.
Site specific decision that:

- the level would not represent a concentrated source of mercury to the rest of the river.
- would shorten the time for the river to recover itself.

Soil:

Mercury:

Site specific risk based decision that is protective of:

- ecological species.
- human health from incidental ingestion and inhalation of volatilized mercury from soil.
- humans and wildlife that consume bottom dwelling organisms and that is based on a dietary level of 0.2 mg/kg.

Value that is protective of sediments within the Southerly Cove of the Penobscot River.

Site specific batch desorption testing outside of the plant area which would be protective of groundwater.

Chloropicrin:

Site specific risk based decision that is protective of human health from incidental ingestion of soil.

Polychlorinated Biphenols:

Federal Toxic Substance Control Authority promulgated clean up number for unrestricted use.

Cadmium:

US EPA, Soil Screening Guideline May 1996 - Groundwater Guideline

Ethylbenzene:

US EPA, Soil Screening Guideline May 1996 - Groundwater Guideline

Xylenes:

US EPA, Soil Screening Guideline May 1996 - Groundwater Guideline

Surface Water (onsite):

Mercury:

Maine Fresh Water Chronic Criteria for non fish eating organisms. Maine Fish Tissue Action Level would be met for onsite fish or not significantly elevated over two other appropriate reference sites. Discharge also must be documented to not lower the existing water quality in the Penobscot River which would currently be about 1.5 ng/l.

Chloroform:

Maine Maximum Exposure Guideline.

Carbon tetrachloride:
Maine Maximum Exposure Guideline.

Surface Water (Penobscot River):
Mercury:
Background in river above Bangor dam.

VI. Corrective Measures Workplan Modifications

The CMS workplan is approved with the following modification:

Section 2, Update of Corrective Measures List:

General provision applies to all media corrective measures under evaluation:

- Ambient air will be monitored during the corrective measures implementation to ensure that safe levels are maintained. In addition the expected releases from each of the corrective measures under evaluation will be considered including an evaluation of modifications or corrective actions that can be taken should unacceptable air levels develop. Timing of work to times most conducive to low emissions will be evaluated.

Retained Corrective Measures for Sediments:

- Stabilization of sediments must be retained for evaluation purposes since reducing the toxicity, mobility and/or volume of a waste may make the waste safer to handle, less apt to volatilize mercury or less apt to migrate in groundwater with time.

Retained Corrective Measures for Soils:

- The excavation and removal of one or more of the onsite landfills shall be considered as an option for evaluation.
- The consolidation of one or more of the onsite landfills shall be considered as an option for evaluation.
- Pipe removal for the industrial sewer.
- The onsite disposal unit (Corrective Action Management Unit) must include the design criteria for RCRA-C units.

Retained Corrective Measures for Surface Waters:

- Erosion control measures including but not limited to sediment socks in catch basins and maintenance of capped and covered areas.
- One measure of the various corrective measures that will be evaluated is the amount of mercury and other contaminants that will be discharged under each of the measures evaluated.

Retained Corrective Measures for Ground Water:

- One measure of the various corrective measures that will be evaluated is the amount of mercury and other contaminants that will be discharged under each of the measures evaluated.

- Treatment technologies will be assessed to evaluate if actions can be taken to remove contaminants from solution and bind them up in soils such that they will not leach. PH neutralization to change groundwater to a less favorable transport pH will be considered.
- Flushing techniques will also be considered to evaluate if remediation can be enhanced through washing of contaminants into a collection system and thereby speeding treatment time for the site.

Section 3, Corrective Measures Evaluation Process

Data Collection:

- The plans for additional data collection must be provided to the ME DEP and US EPA for review and approval prior to implementation.
- Data Control Measures need to be addressed for any additional environmental sampling/analysis. The analytical methods/detection limits to be used must be clarified. The level of data quality required and the quality control acceptance ranges set for laboratory calibration, blank, control samples, spikes and duplicates must be established along with the analytical corrective action.
- Chronic toxicity testing will be conducted at the proposed PMPS level from cove sediments to ensure that this level will not represent a detrimental level for resident species. This can be conducted using a 28 day test at values at least up to 2.2 ppm with hyalella to confirm that sediments at this level are not toxic to directly exposed organisms.
- The percent of methyl mercury to total mercury ratio in the sediment at different times of the year and after storm events when sediment would be stirred up needs to be collected. Alternately a laboratory simulation could be designed.

Overall Protectiveness of Human Health and the Environment:

- The residential scenario and exposure scenarios shall be in accordance with the more stringent of the EPA Region I or the ME DEP Risk Assessment Guidance and policies.

VII. Interim Actions

Mallickrodt shall install groundwater recovery well(s) to capture the more heavily mercury contaminated groundwater downgradient of the industrial site and in the vicinity of landfill #1. The agencies understand that full capture will not be possible in this area until after the CMS due to the close proximity of the Penobscot River.

VIII. Future Decisions

Final Cleanup Decision

After evaluating Mallinckrodt's recommendations for cleanup and other cleanup alternatives, Maine DEP will propose a final cleanup plan and request public input on this plan. This proposed final clean up decision will be presented to the public for comment at a public meeting. The cleanup decision must meet the threshold criteria and represent the best balance of the remaining criteria:

Threshold Criteria (General)

- ❶ Overall protection of human health and the environment.
- ❷ Attainment of media cleanup standards
- ❸ Control of the sources of releases
- ❹ Compliance with applicable waste management standards

Balancing Criteria (Remedy Selection Factors)

- ❶ Long-term reliability and effectiveness
- ❷ Reduction of toxicity, mobility, or volume of hazardous wastes
- ❸ Short-term effectiveness
- ❹ Implementability
- ❺ Cost
- ❻ Community acceptance
- ❼ State acceptance

Corrective Measure Implementation (CMI)

Once all public comments and concerns have been addressed, and a remedial approach and cleanup standards have been selected in a written compliance order, Mallinckrodt can begin the CMI. At this phase of the project, Mallinckrodt will write a detailed design of the final cleanup plan, which will include plans for its construction, operation, maintenance, financial assurance, monitoring and schedule. Mallinckrodt will perform the CMI and Maine DEP will continue to oversee it. U.S. EPA will continue to provide technical support to Mallinckrodt and the State of Maine.

Although many of the cleanup technologies used at RCRA sites are sophisticated, it often is impossible to restore a site to original conditions. Environmental improvements at sites such as HoltraChem often take a long time. In some cases, a restoration cannot be achieved through the use of cleanup technologies alone. Natural processes often play a significant role in cleaning up contaminants in the environment.

Attachment 1

Table 2. Maximum concentration of mercury (mg/kg wet weight) reported for fish collected for monitoring activities in Maine.

Study	Water Bodies Sampled	Fish Type	Maximum	Water body with maximum
1	Lower Androscoggin R. , Merrymeeting Bay, Haraseeket R.	mummichogs (whole)	0.176	Merrymeeting Bay
2	Penobscot R. & tributaries, Androscoggin R., Piscataqua R. (Falmouth)	smallmouth bass (filet)	1.44	Androscoggin
		eel (filet)	0.74	Penobscot & Piscataqua
		white sucker (whole)	0.43	Piscataqua
3	Kennebec R. & tributaries, Sebasticook R., Saint Croix R.	smallmouth bass (filet)	1.01	Sebasticook
		white sucker (whole)	0.43	Kennebec & tributaries
4	York County rivers	smallmouth bass (filet)	0.94	Saco
		eel (filet)	0.64	Kennebunk
		white sucker (whole)	0.19	Mousam
5.	Lakes - whole body samples	bullhead	0.36	Roberts/Wadley Br.
		white sucker	1.2	Duck L.
		brook trout	0.94	Sly Brook L. (Second)
		brown trout	1.25	Cobbosseecontee L.
		lake trout	0.85	Embden P.
		largemouth bass	0.94	Travel P.
		smallmouth bass	1.8	Hodgdon P.
		pickerel	1.20	Machias (Fourth)
		white perch	1.2	Rocky P.
		yellow perch	0.71	Third L.
	Lakes - filet samples	brook trout	0.79	Canada Falls L.
		brown trout	0.78	Range P. (Lower)
		lake trout	0.91	Chain of Ponds
		largemouth bass	0.9	Hicks Pond
		smallmouth bass	2.5	Hodgdon P.
		pickerel	1.22	Forest L.
		white perch	1.05	Bottle L.
		yellow perch	0.81	Bradbury (Barker) L.
1.	Evers, D. 2000. Assessing contaminant availability using kingfishers. 1998 Surface water ambient toxic (SWAT) monitoring report, March 2000. Part 4.3. Maine Department of Environmental Protection. Augusta, Maine.			
3.	Mower, B., J. Reynolds and C. Penny. 2000. 1997 Surface water ambient toxic (SWAT) monitoring report, March 2000. Part 3.1. Maine Department of Environmental Protection, Augusta, Maine.			
2.	Mower, B., J. Reynolds, C. Penny, Penobscot Indian Nation and Acheron, Incorporated. 1999. 1996 Surface water ambient toxic (SWAT) monitoring report. Part 3.1. Maine Department of Environmental Protection. Augusta, Maine.			
4.	Sowles, J., B. Mower, S. Davies, L. Tsomides. 1997. Surface ambient toxic (SWAT) monitoring program. 1995 Technical Report. Maine Department of Environmental Protection. Augusta, Maine.			
5.	Di Franco, J., L. Bacon, B. Mower and D. Courtemanch. 1995. Fish tissue contamination in Maine lakes - data report. Maine Department of Environmental protection. Augusta, Maine.			

WARNING ABOUT EATING SALTWATER FISH AND LOBSTER TOMALLEY

Warning: Chemicals in some Maine saltwater fish and lobster tomalley may harm people who eat them. Women who are or may become pregnant and children should carefully follow the Safe Eating Guidelines.

It's hard to believe that fish that looks, smells, and tastes fine may not be safe to eat. But the truth is that some saltwater fish have mercury, PCBs and Dioxins in them.

All these chemicals settle into the ocean from the air. PCBs and Dioxins also flow into the ocean through our rivers. These chemicals then build up in fish.

Small amounts of mercury can damage a brain starting to form or grow. That's why babies in the womb, nursing babies, and young children are at most risk. Mercury can also harm older children and adults, but it takes larger amounts.

PCBs and Dioxins can cause cancer and other health problems if too much builds up in your body. Since some saltwater fish contain several chemicals, we ask that all consumers of the following saltwater species follow the safe eating guidelines.

Revised February 20, 2001



Environmental Toxicology Program
Maine Bureau of Health

SAFE EATING GUIDELINES

- **Striped Bass and Bluefish:** Eat no more than **2 meals per month**.
- **Shark, Swordfish, King Mackerel, and Tilefish:** Pregnant and nursing women, women who may get pregnant and children under 8 years of age are advised to **not eat** any swordfish or shark. **All other individuals** should eat no more than **2 meals per month**.
- **Canned Tuna:** Pregnant and nursing women, women who may get pregnant and children under 8 years of age can eat no more than **1 can** of "white" tuna or **2 cans** of "light" tuna per week.
- **All other ocean fish and shellfish, including canned fish and shellfish:** Pregnant and nursing women, women who may get pregnant and children under 8 years of age can eat no more than **2 meals per week**.
- **Lobster Tomalley: No Consumption.** While there is no known safety considerations when it comes to eating lobster meat, consumers are advised to refrain from eating the tomalley. The tomalley is the soft, green substance found in the body cavity of the lobster. It functions as the liver and pancreas, and test results have shown the tomalley can accumulate contaminants found in the environment.

For more information, including warnings on freshwater fish call (886)-292-3474 or visit our web site
janus.state.me.us/dhs/bohftp/index.html



LEGEND

- ▲ Hg between 0 and 2.1 ppm
- ▲ Hg between 2.1 and 3.2 ppm
- ▲ Hg between 3.2 and 10 ppm
- ▲ Hg greater than 10 ppm
- ▲ No Data

PERC Outfall
Basemap

 = Generalized hot spot

CDM

125 0 125 Feet

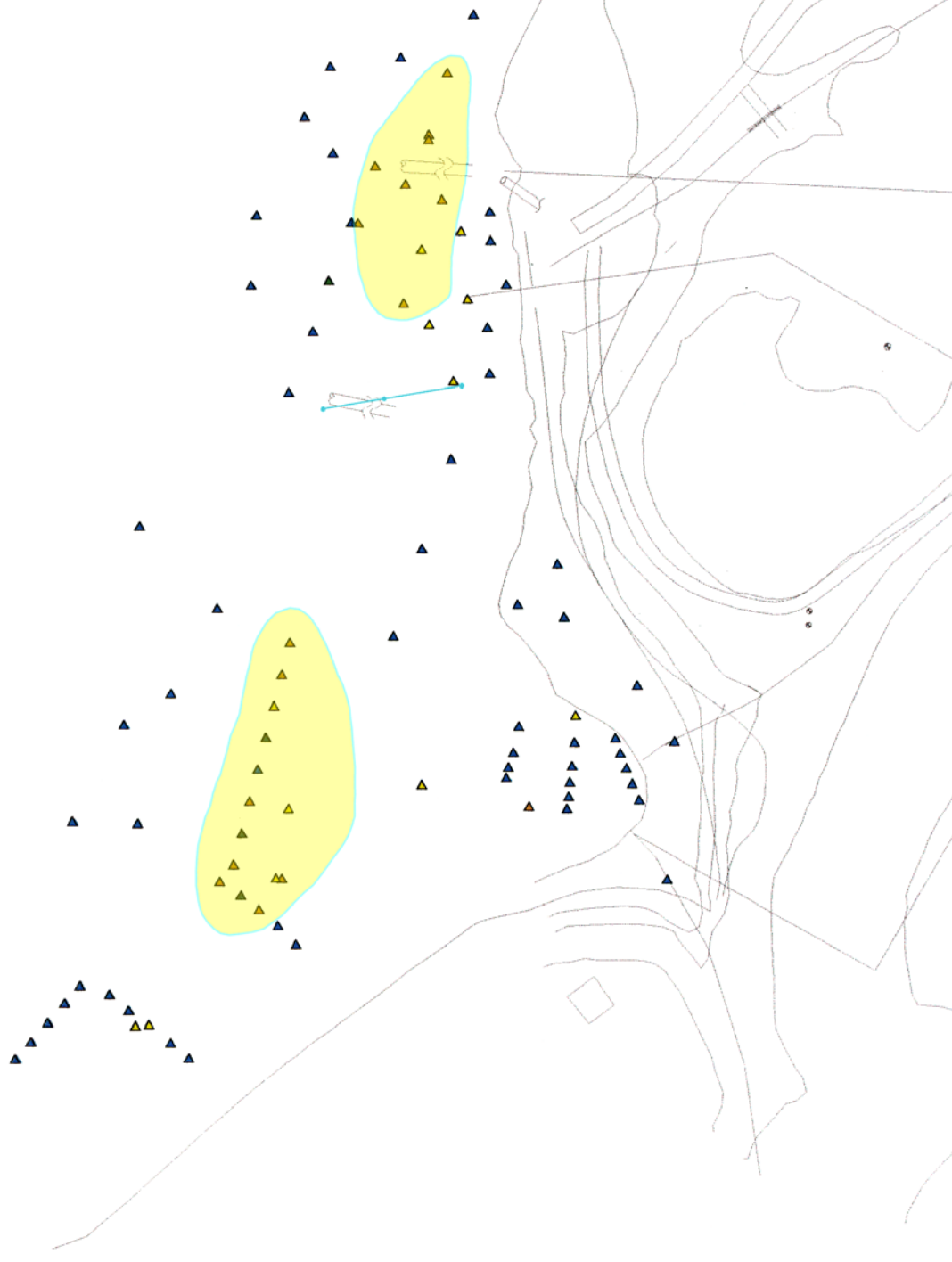


HoltraChem Manufacturing Site
Orrington, Maine

Sediment Sample Data

Depth = Surface to 0.2 ft.

Attachment 3, (2 of 3)



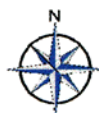
LEGEND

- ▲ Hg between 0 and 2.1 ppm
- ▲ Hg between 2.1 and 3.2 ppm
- ▲ Hg between 3.2 and 10 ppm
- ▲ Hg greater than 10 ppm
- ▲ No Data

PERC Outfall
Basemap



= Generalized hot spot



CDM

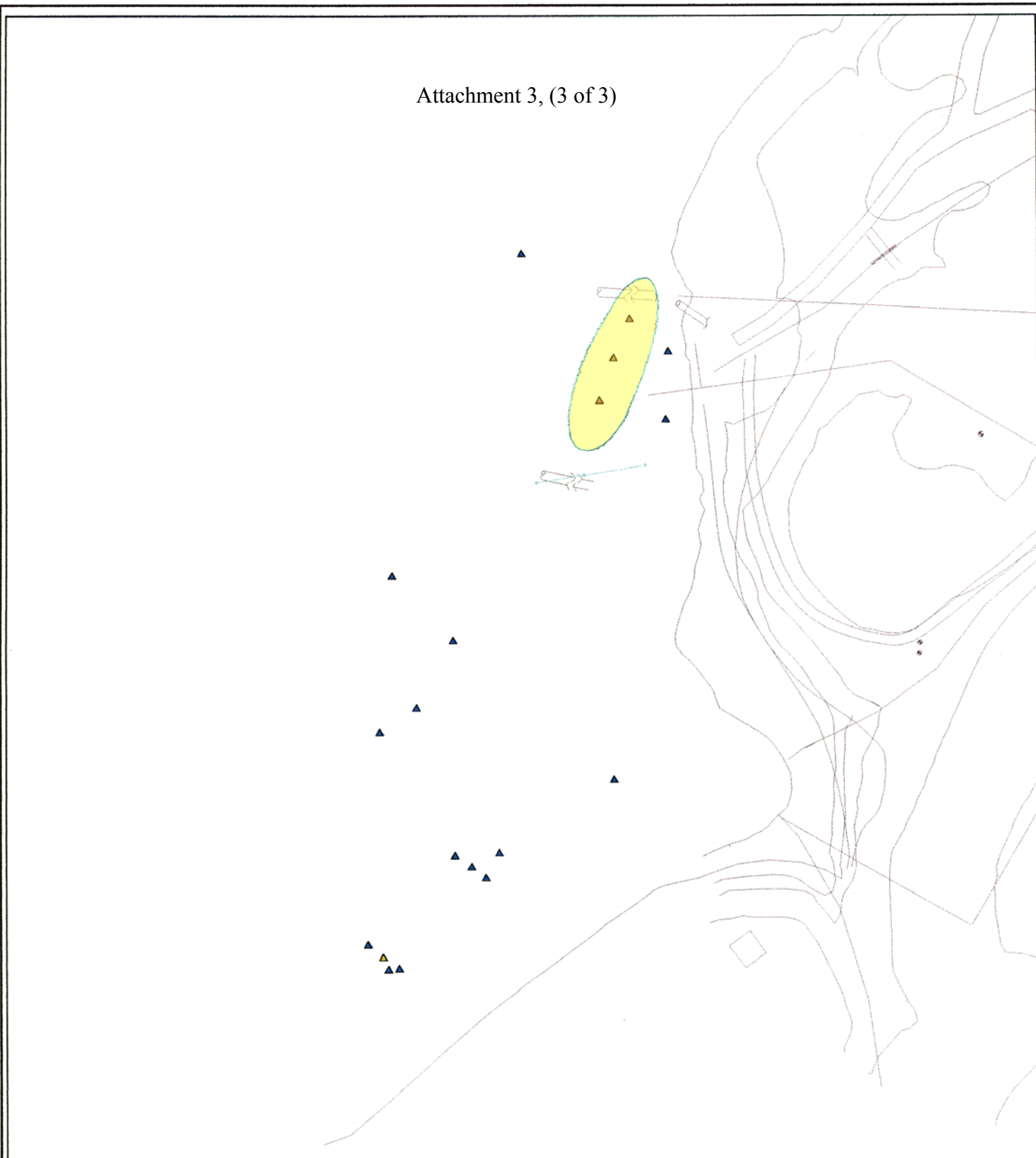
125 0 125 Feet

HoltraChem Manufacturing Site
Orrington, Maine

Sediment Sample Data

Depth, 0.8 - 1.0 ft.

Attachment 3, (3 of 3)



LEGEND

- ▲ Hg between 0 and 2.1 ppm
- ▲ Hg between 2.1 and 3.2 ppm
- ▲ Hg between 3.2 and 10 ppm
- ▲ Hg greater than 10 ppm
- ▲ No Data

PERC Outfall
Basemap



= Generalized hot spot



CDM

125 0 125 Feet

HoltraChem Manufacturing Site
Orrington, Maine

Sediment Sample Data

Depth > 1.0 ft.

Holtrachem workplan